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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/810,923
Filing Date: March 26, 2004
Appellant(s): LEHANE ET AL.

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For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 5/19/08 (supplemental 5/30/08) appealing from the Office action mailed 9/20/07.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

6,720,519	LIU et al.	4-2004
6,621,045	LIU et al.	9-2003
2002/0170891A1	BOYLE et al.	11-2002

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-9, 12-17, & 43 are rejected under 35 U.S.C. 102(b) as being anticipated by Liu et al. (USPN 6,720,519).

Liu et al. ('519) discloses a laser system for micromachining, high precision, controlled hole shapes into a workpiece. The picosecond laser system includes the laser, a beam, a first mirror, a shutter, an attenuator, a second mirror, a beam expander, a third mirror, a fourth mirror, a spinning half wave plate, a scan mirror, a DOE

(diffractive optical element), a plurality of sub-beams, a scan lens, a microfilter, an image transfer lens (can be a large area CCD) and a workpiece. One example of a workpiece is a turbine blade with drilled cooling channels.

A picosecond laser produces short pulses and a DOE is used to split the beam into a plurality of beams, allowing parallel drilling of the workpiece. Controlled hole shape is obtained by using a scan mirror, a milling algorithm and a picosecond laser. The DOE in combination with the scan mirror with piezo-electric actuators is used to control intensity. The ultrafast laser generates intense laser pulses with durations of 10 picoseconds to 10 femtoseconds. Lasers such as excimer, Q-switched, CO_2 and copper vapor are used. The picosecond laser emits a beam of bandwidth less than 0.1 nanometer. The pulse width is approximately 15 picoseconds, with 1W at 1 kHz. Typically a pulse width of between 1 ps and 100 ps is suitable.

The shutter allows the beam to illuminate the workpiece surface in the open position and prevents illumination in the closed position. Shutter speeds are about 1 ms. Alternate embodiments of fast shutters are external electro-optic modulators such as a Pockels cell, a galvanometer mirror that deflects the beam out of the desired beam path or direct modulation of the Q-switch. The instant attenuator includes a half-wave plate and a polarizer.

The scan lens is a f-theta telecentric lens. The scan lens determines the spot size of the sub-beams upon the workpiece. The beam size that enters the entrance pupil of the scan lens must be less than or equal to the pupil size of the scan lens.

Telecentricity is required to keep the incident angle between sub-beams and workpiece perpendicular, which is necessary to drill parallel holes in the workpiece.

Image transfer lens maintains image quality, spot size and telecentricity, while preventing blowback of ablated particles from the workpiece onto the microfilter. The image transfer lens consists of two telecentric scan lenses, identical to scan lens placed back to back, with the pupil planes of the two scan lenses coinciding in the middle. In an alternative embodiment a source of high velocity gas (air or nitrogen) is formed into a laminar flow sheet that passes between the microfilter and workpiece. This flow of gas removes blowback particles before they can be deposited onto the microfilter.

The beam propagates along the optical path, where it is incident upon the first mirror. The first mirror redirects the beam along the optical path, where it is incident upon the shutter. The shutter opens and closes to selectively illuminate the workpiece material. Beams exit the shutter and propagate along the optical path to attenuator. The attenuator filters the energy of the picosecond laser in order to precisely control ablation parameters. Beams exits attenuator and propagate along the optical path, where it is incident upon the second mirror. The second mirror redirects the beam along the optical path, where it is incident upon the beam expander.

Multiple feedback systems are present: examples being, actuators, tool path, laser attenuator, laser optical elements and so forth.

The workpiece is mounted on a computer controlled, programmable translation stage. The XY stage implements the laser milling algorithm that moves the workpiece to achieve the desired shape. The milling algorithm is defined and communicated to the

picosecond laser drilling system with a computing means such as a computer. The computer sends signals to the shutter and scan mirror.

The microfilter controls and equalizes the intensity distribution of multiple laser beams that can be used to produce laser-milled holes in a variety of geometrically repeatable shapes. The intensity distribution of the sub-beams can be measured and analyzed using a feedback step. Sub-beams exit the microfilter and propagate along the optical path, where they are incident upon the image transfer lens. The image transfer lens re-images the focal spots of sub-beams onto the workpiece. Sub-beams then ablate the workpiece in a pattern according to a pre-defined milling algorithm.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 10-11, 19-27, 29-31, 33-40, 42 & 44-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. ('519), as stated in the above paragraph and further in view of Liu et al. (USPN 6,621,045) and Boyle et al. (USPAP 2002/0170891 A1).

Liu et al. ('519) teaches the use of lens and gas, but not the focusing of the lens, the pressure of the gas or the use of a chamber.

Liu et al. ('045) discloses laser drilling using ultrafast sub-beams. The sub-beams may be emitted from a beamsplitter and are used to perform parallel laser drilling of a drilling pattern in the targeted workpiece. The sub-beams are focused on the focal plane (135) (figure 1C). Additionally, during processing, a gas flow (air, nitrogen, argon or another inert gas) creates a reduced atmospheric pressure in front of the target area of the workpiece. The reduction in atmospheric pressure in the range of 2.7 to 56,000 Pascals. (2.7 Pascals equals 20 mTorr) (abstract, figures, col. 4-5)

Boyle et al. discloses the pulsed laser machining (drilling) of a substrate inside an environmentally controlled chamber. (abstract)

It would have been obvious to one of ordinary skill in the art at the time of the invention to focus the lens on the workpiece and determine the gas pressure, as taught by Liu et al. ('045) in the Liu et al. ('519) system because these are merely standard functions and parameters of the lens and gaseous environment.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use an environmentally controlled chamber during drilling as taught by Boyle et al. in the Liu et al. ('519) system because this ensures quality control of the product, that is, contamination effects are negated.

The provision of mechanical or automated means to replace manual activity was held to have been obvious. In re Venner 120 USPQ 192.

(10) Response to Argument

Rejection of Claims 1-9, 12-17, & 43 under 35 U.S.C. 102(b) as being anticipated by Liu et al. (USPN 6,720,519).

Appellant argues that Liu et al. ('519) does not teach each and every element of claim 1.

The examiner respectfully disagrees because Liu et al. ('519) teaches the following:

Appellant's claim 1 limitations:	***Liu et al. ('519) discloses:***
-laser drilling	-laser drilling
-means for emitting a plurality of laser pulses at a part	-...A picosecond laser that produces short pulses is used to reduce thermal effects to improve the quality and repeatability of the milled holes, and a Diffractive Optical Element (DOE) is used to split a single beam into a **plurality of beams to allow parallel drilling of the workpiece**…. (abstract, col. 4,lines 9-15, col. 6, lines 13-20, col. 10, lines 52-57, col. 14, lines 33-41, claims 1, 21 & 75)
-means for positioning part for receiving said plurality of laser pulses	-...the workpiece is mounted on a computer controlled, programmable **XY translation stage.** The XY stage implements the laser milling algorithm that **moves the workpiece to achieve the desired shape in**

	the workpiece by the stationary laser sub-beams…. (col. 7, lines 43-47)
-computer means for controlling operation of deflection means and for orienting said positioning means to drill a shaped hole in said part	-...an apparatus for **driving the position of a laser beam** using a laser drilling system having a **scan mirror with PZT actuators, where the PZT moves in the X-Y-Z plane to adjust the beam deflection,** and a controller that provides instructions to the PZT to control its movement and **directs the laser beam.** -The milling algorithm is defined and communicated to picosecond laser drilling system 100 with a computing means such as a computer (not shown). The **computer sends signals to** shutter 110 and **scan mirror** 130 according to the parameters specified in the milling algorithm. **The combination of the milling algorithm and scan mirror 130 provides high precision and control of the resulting hole shape in workpiece** 155. (col. 4, lines 60-65, col. 9, lines 64-67, col. 10, lines 1-4, col 15, lines 45-54, col. 18, lines 42-62, col. 19, lines 21-44, Figure 10)
-means for providing diagnostic feedback to said computer means, wherein said diagnostic feedback measures an attribute of at least one of said laser pulses during	-...the operator uses **controller/input means** 2131 to execute a tool path **algorithm** (not shown) to control

the progress of said hole being drilled	picosecond laser drilling system 2100 and produce the specified hole geometry in workpiece 2155 using the correction factors identified in step 2420…. …In an alternate embodiment, PZT scan mirror 2130 operates in **closed-loop mode**; however, these devices are considerably slower in response, as they operate in the sub-Hz range. -...method of operating an apparatus for precisely driving the position of a laser beam using a laser drilling system, a PZT, and a **controller means including the steps of correcting for reflection geometry effects, correcting for hysteresis effects, and providing feedback to the PZT controller in order to accurately execute a tool path algorithm.** -...In a second alternate embodiment, attenuator 115 is implemented with a **closed feedback loop** to provide active stabilization…. (col. 5, lines 10-18, col. 6, lines 60-64, col. 17, lines 58-67, col. 18, lines 1-8)

Appellant argues that Liu et al. (‘519) does not teach a diagnostic feedback that measures an attribute of at least one of the laser pulses during the progress of the hole

being drilled. The examiner respectfully disagrees because Liu et al. ('519) discloses the following, with respect to diagnostic feedback:

-...the operator uses **controller/input means** 2131 to execute a tool path **algorithm** (not shown) to control picosecond laser drilling system 2100 and produce the specified hole geometry in workpiece 2155 using the correction factors identified in step 2420…. …In an alternate embodiment, PZT scan mirror 2130 operates in **closed-loop mode**; however, these devices are considerably slower in response, as they operate in the sub-Hz range.

-...method of operating an apparatus for precisely driving the position of a laser beam using a laser drilling system, a PZT, and a **controller means including the steps of correcting for reflection geometry effects, correcting for hysteresis effects, and providing feedback to the PZT controller in order to accurately execute a tool path algorithm.**

-...In a second alternate embodiment, attenuator 115 is implemented with a **closed feedback loop** to provide active stabilization…. (col. 5, lines 10-18, col. 6, lines 60-64, col. 17, lines 58-67, col. 18, lines 1-8)

In addition, the examiner respectfully notes that an attribute of a laser pulse may encompass a multitude of parameters, however, even considering those in appellant's specification: "information such as laser beam's temporal characteristics, alignment and power output..", these may be measured at any point in the system. For example temporal characteristics may be measured by the scan mirror or lens or even at the shutter. Feedback of a pulse attribute.... pulses are formed way back at the splitter or waveplate. Additionally, a laser pulse attribute does not have to be measured at the workpiece as Appellant infers. There are no claim limitations which positively and

specifically state that a laser pulse attribute must be measured at the workpiece; thus a laser pulse attribute may be measured at any point in the apparatus set up.

Appellant argues that the alignment of the microfilter taught by Liu et al. ('519) can only be performed by the operator of the laser system either prior to, or after a drilling operation, but not while drilling is in progress. The examiner respectfully notes that this limitation (alignment) is not recited in the rejected claims (1-9, 12-17 & 43). In response to appellant's argument that the references fail to show certain features of appellant's invention, it is noted that the features upon which appellant relies (i.e., alignment) are not recited in the rejected claim(s) (1-9, 12-17 & 43). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Appellant argues that Liu et al. ('519) places a CCD camera directly in his light path to perform sub-beam alignment and thus cannot provide diagnostic feedback and measure an attribute of at least one of the laser pulses. The examiner respectfully notes that an attribute of a laser pulse may encompass a multitude of parameters, however, even considering those in appellant's specification: "information such as laser beam's temporal characteristics, alignment and power output..", these may be measured at any point in the system. For example temporal characteristics may be measured by the scan mirror or lens or even at the shutter. Feedback of a pulse attribute.... pulses are formed

way back at the splitter or waveplate. Additionally, a laser pulse attribute does not have to be measured at the workpiece as Appellant infers. There are no claim limitations which positively and specifically state that a laser pulse attribute must be measured at the workpiece; thus a laser pulse attribute may be measured at any point in the apparatus set up.

Appellant argues that Liu et al. ('519) does not teach, either explicitly or inherently, that their hardware provides diagnostic feedback by measuring an attribute of at least one of the laser pulses during the progress of a hole being drilled as recited in Appellant's independent claim 1. The examiner respectfully disagrees because Liu et al. ('519) discloses closed loop feedback. It is the position of the examiner that it is well known in the art that a closed loop system feeds back some of the output to the input to effect a control or regulatory action. Thus closed loop feedback, as taught by Liu et al. ('519) inherently teaches diagnostic feedback.

Appellant argues that the presence of the Liu et al. ('519) hardware does not create the inherent presumption that the hardware is being used in the same way and for the same purpose as the means for providing diagnostic feedback as recited in Appellant's claim 1. The examiner respectfully disagrees and furthermore:

-...the operator uses **controller/input means** 2131 to execute a tool path **algorithm** (not shown) to control picosecond laser drilling system 2100 and produce the specified hole geometry in workpiece 2155 using the correction factors identified in step 2420…. …In an alternate embodiment, PZT scan mirror 2130 operates in **closed-loop mode**; however, these devices are

considerably slower in response, as they operate in the sub-Hz range.

-...method of operating an apparatus for precisely driving the position of a laser beam using a laser drilling system, a PZT, and a **controller means including the steps of correcting for reflection geometry effects, correcting for hysteresis effects, and providing feedback to the PZT controller in order to accurately execute a tool path algorithm.**

-...In a second alternate embodiment, attenuator 115 is implemented with a **closed feedback loop** to provide active stabilization…. (col. 5, lines 10-18, col. 6, lines 60-64, col. 17, lines 58-67, col. 18, lines 1-8)

Appellant argues that drilling would be impossible until the CCD camera is removed and the image transfer lens replaced and that this technical requirement taught by Liu et al. ('519) effectively prevents the use of the aforementioned hardware a means for providing diagnostic feedback as recited in Appellants' independent claim 1. The examiner respectfully disagrees because a laser pulse attribute does not have to be measured at the workpiece as Appellant infers. There are no claim limitations which positively and specifically state that a laser pulse attribute must be measured at the workpiece; thus a laser pulse attribute may be measured at any point in the apparatus set up.

Furthermore:

-...the operator uses **controller/input means** 2131 to execute a tool path **algorithm** (not shown) to control picosecond laser drilling system 2100 and produce the specified hole geometry in workpiece 2155 using the correction factors identified in step 2420…. …In an alternate embodiment, PZT scan mirror 2130 operates in **closed-loop mode**; however, these devices are considerably slower in response, as they operate in the sub-Hz range. (col 17 & 18, lines 58-67 & 1-8).

Rejection of Claims 10-11, 19-27, 29-31, 33-40, 42 & 44-45 under 35 U.S.C. 103(a) as being unpatentable over Liu et al. ('519) in view of Liu et al. (USPN 6,621,045) and Boyle et al. (USPAP 2002/0170891 A1).

Appellants argue that there is not motivation to combine the references. In response to appellant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, all the references are directed to analogous art. Liu et al. ('519) is directed to a laser apparatus and method for drilling, Liu et al. ('045) is directed to a laser drilling system and Boyle et al. is directed to the laser machining of a substrate, forming vias (holes). Hence it would have been obvious to one of ordinary skill in the art to combine the references.

Appellant argues that Boyle et al. teaches the use of a chamber which is not required by instant claims. The examiner respectfully notes that claims 19-31, 33-40, 42 & 44-45 have the following limitations:

Independent Claim 19. ...a part **chamber** for holding a part to be drilled... and independent Claim 31. …utilizing a part holder within a part **chamber**…

Appellant argues that difference between the teachings of Liu et al. (‘045) and Boyle et al. effectively prevent one of ordinary skill in the art from being motivated to combine their teachings. The examiner respectfully disagrees because Liu et al. (‘045) and Boyle et al. are secondary references which are combined with the primary reference Liu et al. (‘519). Additionally, both Liu et al. ('045) and Boyle et al. (secondary references) are directed to laser drilling of holes (vias). In response to appellants’ argument that Liu et al. (’045) and Boyle et al. are not combinable, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).

Appellant argues that Liu et al. (‘045) teaches a system and method using a prior art vacuum work piece holder in conjunction with a directed gas flow for drilling a flimsy workpiece. The flow of air across the top surface of the flimsy workpiece creates a low pressure that negates the effects of the impinging laser beams and maintains a constant laser focal plane. Appellant further argues that in contrast Boyle et al. teaches a system of laser machining vias using a single pulsed laser beam and a "cleanroom

chamber", the chamber is used to develop insulating, oxide linings for the vias. One of ordinary skill in the art recognizes Boyle's use of his cleanroom is for a purpose entirely different from the use of the chamber taught by Liu et al. ('045). The examiner respectfully notes that the rejection of claims is over Liu et al. (‘519) in view of Liu et al. (‘045) and Boyle et al. The primary reference Liu et al. (‘519) and the secondary references Liu et al. (‘045) and Boyle et al. are all analogous art: Liu et al. (‘519) is directed to a laser apparatus and method for drilling, Liu et al. ('045) is directed to a laser drilling system and Boyle et al. is directed to the laser machining of a substrate, forming vias (holes). The secondary references: Liu et al. (‘045) are used to teach focusing and gas pressure and Boyle et al. is used to teach a chamber. Liu et al. (‘045) does not teach a chamber for the workpiece. The only chamber Liu et al. ('045) discloses is the ink chamber of an ink jet part which has had holes laser drilled into it. Liu et al. ('045) discloses focusing and an atmospheric pressure of 2.7 Pascal (20 mTorr), as required by instant claims. Boyle et al. teaches a chamber as required by instant claims. With respect to the cleanroom application of Boyle et al. this is an intended use. Boyle et al. discloses the use of a chamber in the laser drilling of vias (holes). In response to appellants’ arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Appellant argues that the claimed laser drilling apparatus of claim 19 does not require or use the system disclosed in Liu et al. (‘045).

Appellant argues that claim element “part chamber” of claim 19 does not compensate for deflections in flimsy workpieces that affect laser focus as taught by Liu et al. ('045). Moreover Appellants' claimed laser drilling apparatus of claim 19 does not require the attention to chemical reactions according to the combined teaching of Liu et al. ('045) and Boyle et al. Liu et al. (‘045) teaches the use of a gas flow to create a reduced pressure in front of the target area of the workpiece while Boyle et al. teaches pulsed laser machining of a substrate inside an environmentally controlled chamber. The examiner respectfully notes that the rejection of claims is over Liu et al. (‘519) in view of Liu et al. (‘045) and Boyle et al. In response to appellants’ arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). The primary reference Liu et al. (‘519) and the secondary references Liu et al. (‘045) and Boyle et al. are all analogous art: Liu et al. (‘519) is directed to a laser apparatus and method for drilling, Liu et al. ('045) is directed to a laser drilling system and Boyle et al. is directed to the laser machining of a substrate, forming vias (holes). The secondary references: Liu et al. ('045) discloses focusing and an atmospheric pressure of 2.7 Pascal (20 mTorr), as required by instant claims. Boyle et al. teaches a chamber as required by instant claims.

Appellant argues that prior art fails to teach, suggest or disclose a means for providing diagnostic feedback (Appellants' claim 1), diagnostic feedback (Appellants' claim 19), providing diagnostic feedback (Appellants' claim 31) or even mention a diagnostic component recited in Appellants' dependent claim 42. The examiner respectfully disagrees because Liu et al. ('519) discloses closed loop feedback. It is the position of the examiner that it is well known in the art that a closed loop system feeds back some of the output to the input to effect a control or regulatory action. Thus closed loop feedback, as taught by Liu et al. ('519) inherently teaches diagnostic feedback. Furthermore, diagnostic feedback is taught by Liu et al. ('519), as follows:

-...the operator uses **controller/input means** 2131 to execute a tool path **algorithm** (not shown) to control picosecond laser drilling system 2100 and produce the specified hole geometry in workpiece 2155 using the correction factors identified in step 2420…. …In an alternate embodiment, PZT scan mirror 2130 operates in **closed-loop mode**; however, these devices are considerably slower in response, as they operate in the sub-Hz range.

-...method of operating an apparatus for precisely driving the position of a laser beam using a laser drilling system, a PZT, and a **controller means including the steps of correcting for reflection geometry effects, correcting for hysteresis effects, and providing feedback to the PZT controller in order to accurately execute a tool path algorithm.**

-...In a second alternate embodiment, attenuator 115 is implemented with a **closed feedback loop** to provide active stabilization…. (col. 5, lines 10-18, col. 6, lines 60-64, col. 17, lines 58-67, col. 18, lines 1-8)

Appellant argues that Liu et al. ('519), Liu et al. ('045) and Boyle et al. do not teach, that the hardware provides diagnostic feedback in the apparatus by measuring an attribute of at least one of the laser pulses during the progress of a hole being drilled as recited in Appellant's claims. The examiner respectfully disagrees because Liu et al. ('519) discloses closed loop feedback. It is the position of the examiner that it is well known in the art that a closed loop system feeds back some of the output to the input to effect a control or regulatory action. Thus closed loop feedback, as taught by Liu et al. ('519) inherently teaches diagnostic feedback.

Appellant argues that the presence of the Liu et al. ('519) hardware does not create the inherent presumption the hardware is being used in the same way and for the same purpose as the means for providing diagnostic feedback recited in Appellant's claim 1. The examiner respectfully disagrees and furthermore:

-...the operator uses **controller/input means** 2131 to execute a tool path **algorithm** (not shown) to control picosecond laser drilling system 2100 and produce the specified hole geometry in workpiece 2155 using the correction factors identified in step 2420…. …In an alternate embodiment, PZT scan mirror 2130 operates in **closed-loop mode**; however, these devices are considerably slower in response, as they operate in the sub-Hz range.

-...method of operating an apparatus for precisely driving the position of a laser beam using a laser drilling system, a PZT, and a **controller means including the steps of correcting for reflection geometry effects, correcting for hysteresis effects, and providing feedback to the PZT controller in order to accurately execute a tool path algorithm.**

-...In a second alternate embodiment, attenuator 115 is implemented with a **closed feedback loop** to provide active

stabilization…. (col. 5, lines 10-18, col. 6, lines 60-64, col. 17, lines 58-67, col. 18, lines 1-8)

Appellant argues that even if Liu et al. (‘045) or Boyle et al. taught any one of Appellants’ claimed diagnostic feedback claim elements, Liu et al. (‘519) teaches that when a CCD camera is placed in the position of image transfer lens, the optical light path to the workpiece is blocked. Drilling would be impossible until after the CCD camera is removed and the image transfer lens is replaced. This technical requirement taught by Liu et al. ('519) effectively prevents the use of the aforementioned hardware as a means for providing diagnostic feedback as recited in Appellants’ claims 1, 19, 31 & 42. The examiner respectfully notes that the diagnostic feedback measures an attribute of the at least one laser pulse during the progress of the said hole being drilled; as per Appellants’ claim limitation. In addition, the examiner respectfully notes that an attribute of a laser pulse may encompass a multitude of parameters, however, even considering those in appellant's specification: "information such as laser beam's temporal characteristics, alignment and power output..", these may be measured at any point in the system. For example temporal characteristics may be measured by the scan mirror or lens or even at the shutter. Feedback of a pulse attribute... pulses are formed way back at the splitter or waveplate. Additionally, a laser pulse attribute does not have to be measured at the workpiece as appellant infers. There are no claim limitations which positively and specifically state that a laser pulse attribute must be measured at

the workpiece, thus a laser pulse attribute may be measured at any point in the apparatus set up.

Appellants' argues that there is no motivation to combine Liu et al. ('519), Liu et al. ('045) and Boyle et al. In response to appellants' argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, all the references are directed to analogous art. Liu et al. ('519) is directed to a laser apparatus and method for drilling, Liu et al. ('045) is directed to a laser drilling system and Boyle et al. is directed to the laser machining of a substrate, forming vias (holes). Hence it would have been obvious to one of ordinary skill in the art to combine the references.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/M. Alexandra Elve/

M. Alexandra Elve

Primary Examiner, Art Unit 3742

Conferees:

/Henry Yuen/

Henry Yuen

Special Programs Examiner, TC 3700

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